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The design of an embedded system from idea to product.

Introduction

In the past teaching embedded system was often just a pile-up of different courses. However, tackling the complexity of the real design process, we needed a new pedagogical and technical approach to introduce this process to students.

Experience has shown that every new educational technology needs to be coupled with appropriate pedagogy. The pedagogy of teaching a subject is dependent on the technology used, and technology used in learning materials demand for a special pedagogical approach. The management of the development of the materials and methods proofs to be a huge task and demands for a multi-disciplinary team. [1]

In putting forward a new approach in the teaching and learning method for the subject of design of embedded systems, aim is to appeal to students for efficient learning. The case is on embedded systems to offer students a real life case of product design all the way down from idea to production [2].

BCA (Baby Car Alarm project)

The BCA is a student project where students have to work together in multidisciplinary student teams to produce an alarm system for the protection of infants in cars. The BCA will send an alarm call to the parents when they forget their child in the car on hot or cold days, with possible lethal consequences. The goal is not only to make a functional prototype, but also to take all technical and legal limitations in account for mass-production and commercial market release. Moreover, they needed to work as much as possible in a parallel fashion to rapidly produce a working prototype as to get acquainted to concepts of hardware/software/mechanical co-design, rapid prototyping and time-to-market.

The need for formal communication, planning and collaboration in different fields of expertise is decisive for a successful product development. This demands a multi-disciplinary team of teachers (for development of the courses) and teams of students (for running the student project).

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The teaching team consists of 5 people: hardware and software engineering, mechanical engineering and project management.

There are 3 student teams defined: the hardware team which is responsible for the functional and structural design of an embedded system and legal matters, the software team which develops the necessary software according to safe-coding standards and the mechanical team which provides a sturdy housing for the product. Moreover, this mechanical team needs to take the automated production of the case into account. The eventual goal for mechanical production is injection molding. For the prototype a 3D-printer is used for rapid prototyping.

For all the teams to work together, a thorough preliminary investigation was necessary to define all functional and production requirements and to perform a risk analysis, both on the end-product as on the design and production process.

Result is a functional prototype, with a printed housing and all necessary measures to avoid EMC / EMI problems, to provide resilience to shock or vibration of the hardware and with design-for-manufacturing in mind.

Conclusions.

The case showed that a multi-disciplinary approach in the design and realization of a new learning method is valuable, and even quite indispensable in engineering (studies). This is a necessity for teachers working together in the development of new learning strategies and also an attitude which should be thought to students in project work.

Secondly, working on the case showed that the management/organization needs to be open-minded and supportive of the idea of multi-disciplinary teams. And to be more specific, it should offer real support on the work, not only supportive words. The management's belief that computers will solve everything just by being present, needed to be converted to a belief in people who get the best out of their tools when collaborating. From the point of organization, the multi-disciplinary approach in which every teacher had to cross-border his subject-territory, was a painstaking process, but in the end it was a successful attempt to make a new learning environment available for the students.

References

1. Kozik, T., Simon, M. , Preparing and managing the remote experiment in education., *International Conference ICL IGIP 2012*, Villach, Austria, 2012
2. Van Merode, D., Arras, P., Van Bauwel, J., Use of state of the art ECAD design tools in high innovative studies, CADSM2013, 978-617-607-393-2, p. 72-79, (2013)